

**EXPLANATION OF SIGNIFICANT DIFFERENCES  
OPERABLE UNIT 10 RECORD OF DECISION  
AVTEX FIBERS SUPERFUND SITE**

**I. INTRODUCTION**

Site Name: Avtex Fibers Superfund Site

Site Location: Front Royal, Warren County, Virginia

Lead Agency: United States Environmental Protection Agency Region III

Support Agency: The Virginia Department of Environmental Quality ("VDEQ")



EPA is issuing this Explanation of Significant Differences ("ESD") for the Avtex Fibers Superfund Site ("Site") to extend the area to be remediated. Specifically, the definition of Plant Area Soils will be expanded to include an additional area based in part on new information showing additional contamination. The Operable Unit 10 Record of Decision ("OU-10 ROD") dated March 10, 2004 describes Plant Area Soils as potentially impacted soils on the eastern portion of the Site (east of the railroad tracks) surrounding the footprint of the former manufacturing buildings. However, Figure 3 contained in the OU-10 ROD depicts the areal extent of the Plant Area Soils as an area north of the east-west oriented Kerfoot Road Gate/railroad crossing road. This ESD defines an additional area to be included in the Plant Area Soils and presents cleanup levels for the area consistent with the way cleanup levels were established for Plant Area Soils in the OU-10 ROD. These levels are set to reflect the anticipated land use of this additional portion of the property as recreational rather than the commercial/light industrial cleanup levels which were identified and remain appropriate for the original area identified in the OU-10 ROD.

**II. STATEMENT OF PURPOSE**

This ESD is being issued in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, ("CERCLA"), 42 U.S.C. § 9617(c), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. § 300.435(c)(2)(i), and is now a part of the Administrative Record for the Site. This ESD significantly changes, but does not fundamentally alter, the remedy selected in the OU-10 ROD with respect to scope, performance, or cost. This ESD has been prepared to provide the public with an explanation of modifications to the selected remedy for Plant Area Soils required by the OU-10 ROD, to summarize the information that supports this modification, and to affirm that the revised remedy complies with the statutory requirements of Section 121 of CERCLA, 42 U.S.C. § 9621. This is the first ESD issued for the Site.

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### **III. SUMMARY OF THE SITE HISTORY, SITE CONDITIONS, AND SELECTED REMEDY**

The Site is the location of a former fibers manufacturing plant (National Superfund Database ID No. VAD070358684) located in Front Royal, Warren County, Virginia. The Site is located in northwestern Virginia, along the boundary of the Blue Ridge Mountains and the northern entrance of Skyline Drive in the Shenandoah National Park. The Randolph Macon Academy borders the Site along the eastern boundary. The former General Chemical facility plant is located along the north/northwest boundary of the property. Residential areas are located to the north, south and east of the property boundaries.

The facility occupies approximately 440 acres situated on the east bank of the South Fork of the Shenandoah River ("River"). The Site property is bisected by the Norfolk Southern Railway Company railroad (the Norfolk Southern) that separates the former plant production area from the former waste disposal areas. The plant area occupies approximately 200 acres east of the railroad tracks, the features of which during operation included approximately 60 acres of manufacturing and administrative buildings, tank storage areas, open fields and parking lots. The area west of the railroad tracks, encompassing approximately 240 acres, includes 23 impoundments and fill areas, and a wastewater treatment plant ("WWTP"). A groundwater plume from the impoundment area extends under the River and beneath some property on the west bank of the South Fork of the River ("Rivermont Acres").

Operations at the Site began in 1940, when American Viscose opened a rayon production plant. In 1963, American Viscose sold the plant and property to FMC Corporation ("FMC"), and in 1976, the plant and property were sold by FMC to Avtex Fibers, Inc. Subsequently, Avtex Fibers, Inc., conveyed the plant and property to its wholly-owned affiliate Avtex Fibers-Front Royal, Inc. (hereinafter both of the latter companies will be referred to as "Avtex"). Rayon fibers were continually produced until the plant abruptly closed in 1989. Polyester and polypropylene were also produced over short periods of time.

The plant manufacturing operations generated three major waste types. The first type was generated when the waste acid from the production process was treated with lime in the WWTP; the metal bearing sludge generated by that treatment was placed in six sulfate basins. The second waste type was fly ash generated from the combustion of coal in the onsite power plant. Fly ash was disposed in four impoundments and one stockpile. The third waste type was waste viscose that was disposed in eleven onsite viscose basins. This waste was primarily an off-specification viscose from the production process. In addition, solid wastes were placed in an onsite solid waste landfill that was permitted by Virginia.

The combined efforts of EPA's Removal, Enforcement and Remedial programs have been used to address the many environmental problems at the Site. In October 1984, the Site was proposed for inclusion on the CERCLA National Priorities List ("NPL"), and on June 10, 1986, the listing was made final. Since being listed on the NPL, the Site has been the subject of numerous response actions performed by Avtex prior to filing for bankruptcy in 1990, former

owner FMC or EPA. Due to the magnitude and complexity of the environmental problems at the Site a variety of time-critical removal actions, non-time critical removal actions and remedial responses have been undertaken.

EPA and FMC entered into an EPA administrative order in 1993 requiring FMC to investigate the Site more thoroughly. In 1993 and 1994, EPA and FMC conducted a Site-wide Remedial Investigation ("RI") of buildings, sewers, waste disposal areas, on-site soils and ground water to assess the environmental condition of the Site. During late 1998 and early 1999, FMC and the United States finalized negotiations on a global settlement that resulted in a commitment by FMC to conduct all future response actions at the Site pursuant to the terms of a Federal Consent Decree. The agreement was entered by the Court in U.S. v. FMC Corp., Civ. No. 5-99CV000.54 (W.D.VA 1999) ("the Consent Decree") and became effective October 21, 1999. The Consent Decree requires, among many things, that FMC finance and conduct response actions for the Site based upon decision documents to be issued by EPA.

The OU-10 Remedial Action is part of on-going clean-up activities at this Site. FMC is implementing activities associated with OU-10 pursuant to the Consent Decree. The Site-wide investigations, coupled with data collected to support the completion of the Feasibility Study, supported the identification of the selected remedy for OU-10. OU-10 consists of Viscose Basins 1 through 8, the New Landfill, and the Plant Area Soils. Figure 1 in the OU-10 ROD showed a map of the Site which identified all the areas being addressed.

EPA selected a remedial action in the OU-10 ROD. The selected remedy for Viscose Basins 1 through 8 includes improving the existing soil covers and collecting and treating leachate. The selected remedy for the New Landfill includes constructing a soil cap and collecting and treating leachate. The final area included in the OU-10 ROD, and the focus of this ESD, is the Plant Area Soils. The selected remedial action requires cleanup of Plant Area Soils to levels that protect human health and the environment.

Impacted Plant Area soils are defined in the OU-10 ROD as those soils with contaminant levels exceeding the soil cleanup standards included as Table 1 in the OU-10 ROD. The Plant Area Soils remedy requires: excavation of soils contaminated above defined criteria with stabilization of hazardously characteristic soils due to metals; off-site disposal of all treated and untreated soils with contaminant concentrations that result in exceedances of specified ground water protection standards and all soils containing 50 mg/kg or greater Total PCBs; and either on-site disposal or off-site disposal of remaining excavated soils.

#### **IV. BASIS FOR THE DOCUMENT**

The OU-10 ROD describes Plant Area Soils as consisting of potentially impacted soils located on the eastern portion of the Site (east of the railroad tracks) surrounding the footprint of the former manufacturing plant. Figure 3 in the OU-10 ROD depicts the extent of the Plant Area Soils as an area north of the east-west oriented Kerfoot Road Gate/railroad crossing road. Since then EPA has determined that additional areas of concern exist that warrant response action.

The approximately 36-acre area south of the road is an area planned for recreational use and has been named the Proposed Skyline SoccerPlex parcel. Sampling and grading activities have identified contaminated waste and soil and potentially contaminated waste and soil in three areas within the Proposed Skyline SoccerPlex parcel: Soils in Vicinity of SoccerPlex Area, Burnt Debris/Ash Area, and the Coal Seam Area.

Soils in the Vicinity of SoccerPlex Area consist of an approximate 3-acre area in the northwestern corner of the Proposed SoccerPlex Parcel. Surface soil sampling at depths of 0 to 2 feet was conducted throughout the Parcel in May 2003. Elevated arsenic concentrations (up to 158 mg/kg) have been identified in surface soil in the 3-acre area.

Burnt Debris/Ash Area is an area discovered during clearing, grubbing and rough grading of the Proposed Skyline SoccerPlex Parcel. To facilitate the community's development of the soccer fields on the parcel, FMC provided the labor and equipment to clear, grub, and rough grade the Proposed Skyline SoccerPlex Parcel. During these activities, an area of inert construction debris (brick, coal, concrete, glass, metal, and wood) was encountered at the northern end of the parcel. Test pits were dug to evaluate the horizontal and vertical extent of the debris. One test pit contained black ash and lesser amounts of viscose material, rayon fiber and other burnt debris (wooden planks, round pieces of melted lead, brick, metal, glass). A composite characterization sample of this material indicated it was characteristically hazardous for lead and contained elevated concentrations of other metals.

Finally, a material with a coal-like appearance was revealed during the grading of the Proposed SoccerPlex Parcel. The area is identified as the Coal Seam Area.

Figure 3A shows the area that shall be referred to as the Expanded Plant Area Soils. The additional areas described above (i.e., Soils in Vicinity of SoccerPlex Area, Burnt Debris/Ash Area, and the Coal Seam Area) are included as part of the Expanded Plant Area Soils.

## **V. DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE BASIS FOR SUCH DIFFERENCES**

EPA is issuing this ESD to describe changes to the Plant Area Soils portion of the remedy selected in the OU-10 ROD due to the identification of contaminated waste and soil and potentially contaminated waste and soil outside the Plant Area Soils footprint included in the OU-10 ROD. Except for the specific changes discussed below, all terms of the OU-10 ROD remain in effect.

### **1. Remedy Modification**

The OU-10 ROD describes Plant Area Soils as potentially impacted soils located on the eastern portion of the Site (east of the railroad tracks) surrounding the footprint of the former

manufacturing plant. The areal extent of potentially impacted soils was included in the OU-10 ROD as Figure 3. As discussed in Section IV. above, several areas with known contaminated waste and soil and potentially contaminated waste and soil have been discovered outside the area defined as Plant Area Soils. The Expanded Plant Area Soils is now included as part of Plant Area Soils. The modifications to the OU-10 ROD described below address the known and potentially contaminated waste and soil that have been found in the area.

a. Summary of Rationale for the Expanded Plant Area Soils

Consistent with Section L.3.b.1 (2) of the OU-10 ROD, the soil cleanup standards for the Expanded Plant Area Soils shall not exceed a cumulative excess cancer risk of  $1 \times 10^{-4}$ . The cumulative effect for non-carcinogens on any target organ shall not exceed a HQ of 1. In the OU-10 ROD, the risk-based numeric soil cleanup standards for the protection of human health due to direct contact are the direct contact standards calculated according to the procedures utilized in the EPA Region III Risk-based Concentration Table (April 2003 Version) for industrial soil, except that an indoor worker exposure scenario (soil ingestion = 50 mg/day) was used instead of the outdoor worker scenario (soil ingestion = 100 mg/day).

For the Expanded Plant Area Soils, an updated table, Table 1A, shall be used to identify soils to be excavated. Table 1A includes risk levels based on the EPA Region III Risk-based Concentration Table (October 2005 Version) and upper tolerance limits (UTLs) developed using background soils data from the USGS Virginia data<sup>1</sup> and EPA UTL methodology (EPA, 1992<sup>2</sup>). The Expanded Plant Area Soils will be used for recreational purposes; therefore, risk-based concentrations ("RBCs") for residential soil rather than industrial soils are presented in Table 1A. In order to determine the appropriate cleanup levels to meet these requirements, analytical results shall first be compared to the RBCs and UTLs presented in Table 1A. In the case where the RBC or UTL values are exceeded, then an area specific (i.e., recreational use) cumulative risk assessment may be conducted. If the cumulative risk results exceed the risk management thresholds specified above, then the soils associated with that data are defined as impacted Expanded Plant Area Soils that shall require excavation.

For Expanded Plant Area Soils, the direct contact cleanup standard for Total PCBs shall be 1 ppm, based on risk analysis and consistent with 40 CFR § 761.61(c). The OU-10 ROD specified a direct contact cleanup standard for Total PCBs of 25 ppm to ensure that future Site workers at the commercial office park proposed by the Warren County/Town of Front Royal Economic Development Authority (EDA) are adequately protected against exposure to residual

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<sup>1</sup> Boerngen, Josephine G., and Shacklette, Hansford T., 1981, Chemical analyses of soils and other surficial materials of the conterminous United States: U.S. Geological Survey Open-File Report 81-197, U.S. Geological Survey, Denver, CO.

<sup>2</sup> US EPA, 1992, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Addendum to Interim Guidance. July 1992.

soil contamination. This level is risk-based and consistent with the cleanup requirements found in 40 CFR § 761.61(c). The PCB cleanup standard is also consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination", EPA 540 G-90-007, August 1990. Page 27, Table 3-1. The surface soils in the Expanded Plant Area Soils shall be addressed to ensure that the recreational user is adequately protected against exposure to residual soil contamination.

b Description of Modification Specific to Burnt Debris/Ash Area

i Material from the Burnt Debris/Ash Area

- (1.) Material from the Burnt Debris/Ash Area shall be excavated until the area is visually clean
- (2.) Excavated material from the Burnt Debris/Ash Area is characteristically hazardous and shall be disposed at an off-site Subtitle C landfill in accordance with Section 121 (d)(3) of CERCLA and 40 C.F.R. § 300.440.

- ii. Soils associated with the Burnt Debris/Ash Area shall be addressed in accordance with the requirements for the Description of Modification for all Soils in the Expanded Plant Area in Section V.1.d i.-vi below.

c Description of Modification Specific to Coal Seam Area

i Coal-like Material from the Coal Seam Area

- (1.) The coal-like material shall be characterized for both total and synthetic precipitation leaching procedure (SPLP) constituents (e.g., metals, VOCs, SVOC, PCBs, pesticides). Data quality objectives shall be developed for this effort and a sampling and analysis plan shall be prepared in accordance with EPA's Guidance for the Data Quality Objectives Process, EPA QA/G-4 (September 2000) and/or any other relevant guidance, and submitted to EPA and the VDEQ for approval by EPA.
- (2.) Coal-like material from Coal Seam Area shall be excavated until the area is visually clean if the cumulative risk results exceed the risk management thresholds specified above.
- (3.) Coal-like material excavated from the Coal Seam Area shall be beneficially reused off-site with prior approval of EPA and in accordance with Section 121(d)(3). If EPA determines that the excavated coal-like material cannot be beneficially reused off-site, it shall be disposed at an off-site Subtitle D landfill in accordance with Section 121 (d)(3) of CERCLA.

- ii. Soils associated with the Coal Seam Area shall be addressed in accordance with the requirements for the Description of Modification for all Soils in the Expanded Plant Area in Section V.1.d.1 -vi. below.

d. Description of Modification for all Soils in the Expanded Plant Area

- i. The soil cleanup standards for OU-10 Expanded Plant Area Soils shall not exceed a cumulative excess cancer risk of  $1 \times 10^{-4}$ . The cumulative effect for non-carcinogens on any target organ shall not exceed a HQ of 1. Table 1A shall be used to identify the soil cleanup standards

- ii. Pre-remediation sampling and analysis to further delineate the lateral and vertical extent of soils with contaminant levels exceeding the OU-10 Expanded Plant Area Soil cleanup standards shall be conducted as described in the paragraph below.

- (1.) Expanded Plant Area soils shall be characterized for both total and synthetic precipitation leaching procedure (SPLP) constituents (e.g., metals, VOCs, SVOC, PCBs, pesticides). Data quality objectives shall be developed for this effort and a sampling and analysis plan shall be prepared in accordance with EPA's Guidance for the Data Quality Objectives Process, EPA QA/G-4 (September 2000) and/or any other relevant guidance, and submitted to EPA and the VDEQ for approval by EPA.

iii. Soils Requiring Excavation

- (1.) All soils in the Expanded Plant Area with contaminant concentrations resulting in exceedances of the OU-10 Expanded Plant Area soil cleanup standards as explained in V.1.a. shall be excavated.

iv. On-site Use of Soils

- (1.) All soils from the Expanded Plant Area Soils with Total PCB concentrations greater than 1 mg/kg Total PCB, but less than 50 mg/kg PCB, shall be used in basin or landfill closures below the infiltration layer. If EPA determines that soils with Total PCB concentrations greater than 1 mg/kg Total PCB, but less than 50 mg/kg PCB, cannot be used in basin or landfill closures, they shall be disposed off-site in accordance with 40 CFR § 761.61(a)(5)(i)(B)(2)(iii).

- (2.) All soils from the Expanded Plant Area Soils with contaminant concentrations which exceed the OU-10 direct contact standards, but do not result in exceedances of the OU-10 ground water protection soil standards in Table 1A, may be used to backfill subgrade structures below a depth of 10 feet or in basin or landfill closures below the infiltration layer.

v. Off-site Disposal of Soils

- (1.) All soils from the Expanded Plant Area with Total PCB concentrations 50 mg/kg or greater shall be disposed off-site in accordance with 40 CFR § 761.61(a)(5)(i)(B)(2)(iii).
- (2.) Soils with contaminant concentrations which result in exceedances of the OU-10 ground water protection soil standards in Table 1A shall be disposed at an off-site Subtitle D landfill in accordance with Section 121 (d)(3) of CERCLA and 40 C.F.R. § 300.440

vi. Post Excavation Work

- (1.) Confirmatory sampling shall be conducted to ensure the cleanup standards are met in the excavation.
- (2.) Excavated areas shall be backfilled and/or graded to prevent ponding of water
- (3.) A stable vegetation shall be established over the excavated areas to prevent erosion by seeding and mulching.

2. Overall Protection of Human Health and the Environment

The selected remedy set forth in the OU-10 ROD was protective of human health and the environment at the time the OU-10 ROD was signed. Since then EPA has determined that additional areas of concern exist that warrant response action. The modification to the remedy called for in this ESD is also protective of human health and the environment by eliminating, reducing or controlling unacceptable contaminant exposures to the recreational user through excavation and removal of contaminated material and soils. The selected remedy for the Expanded Plant Area Soils will prevent direct contact with soils containing contaminants which result in exceedances of health-based levels. The remaining potential human health risk levels will be within EPA's acceptable risk range for carcinogens (less than  $1 \times 10^{-4}$ ) and the non-carcinogen hazard will be below the level of concern (a hazard quotient less than or equal to 1)



### 3. Applicable or Relevant and Appropriate Requirements (ARARs)

This ESD does not fundamentally change the remedy. The remedy for the Expanded Plant Area Soils will attain all remedy-specific applicable or relevant and appropriate requirements, which are included in Table 2 of the OU-10 ROD. Based on the anticipated future land use one new ARAR has been identified. A new cleanup level for Total PCBs is being established to reflect the anticipated land use of the Expanded Plant Area Soils as recreational rather than the commercial/light industrial anticipated land use for the original area identified in the OU-10 ROD. A cleanup level of 25 ppm Total PCBs was identified for the original area identified in the OU-10 ROD and remains appropriate for that area.

The Total PCB soil cleanup standard for the Expanded Plant Area Soils shall be 1 mg/kg. This cleanup standard is risk-based and is consistent with the substantive standards of 40 CFR § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups (see 40 CFR § 761.61(a)(1)(ii)), EPA determined that the risk-based cleanup approach found in 40 CFR § 761.61(c) is relevant and appropriate to this cleanup, and that the 1 mg/kg Total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is also consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990.

### 4. Cost Effectiveness

The total area to be addressed as Plant Area Soils was estimated to be 65 acres in the OU-10 ROD. Through this ESD an additional 6 acres is estimated to be included in the Plant Area Soils. This will result in an estimated \$200,000 in additional costs. The modifications to the selected remedy presented in this ESD are protective of human health and the environment.

## VI. SUPPORT AGENCY REVIEW

EPA has notified the Commonwealth of Virginia of the changes proposed in this ESD in accordance with 40 C.F.R. § 300.435(c)(2). The Commonwealth of Virginia has concurred with this ESD.

## VII. AFFIRMATION OF THE STATUTORY DETERMINATIONS

EPA has determined that the revised remedy complies with the statutory requirements of Section 121 of CERCLA, 42 U.S.C. § 9621. Considering the changes that have been made to the scope of the selected remedy, EPA and VDEQ have determined that the remedy remains protective of human health and the environment, complies with Federal and State requirements that were identified in the OU-10 ROD as applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site.

### **VIII. PUBLIC PARTICIPATION**

This Explanation of Significant Differences is available for review in the Administrative Record file for the Site at the following locations:

Samuels Public Library  
538 Villa Avenue  
Front Royal, VA  
(540) 635-3153

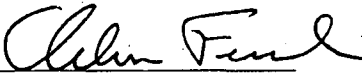
U S. EPA - Region III Docket Room  
Ms. Anna Butch  
1650 Arch Street  
Philadelphia, PA 19103  
(215) 814-3157

The Administrative Record File can also be viewed at <http://www.epa.gov/arweb> or at the Administrative Record link on the sidebar of the U S. EPA Region 3 Hazardous Waste Site Cleanup Division homepage at <http://www.epa.gov/reg3hwmd>.

Questions or comments on EPA's action and requests to review the Administrative Record at EPA's office can be directed to:

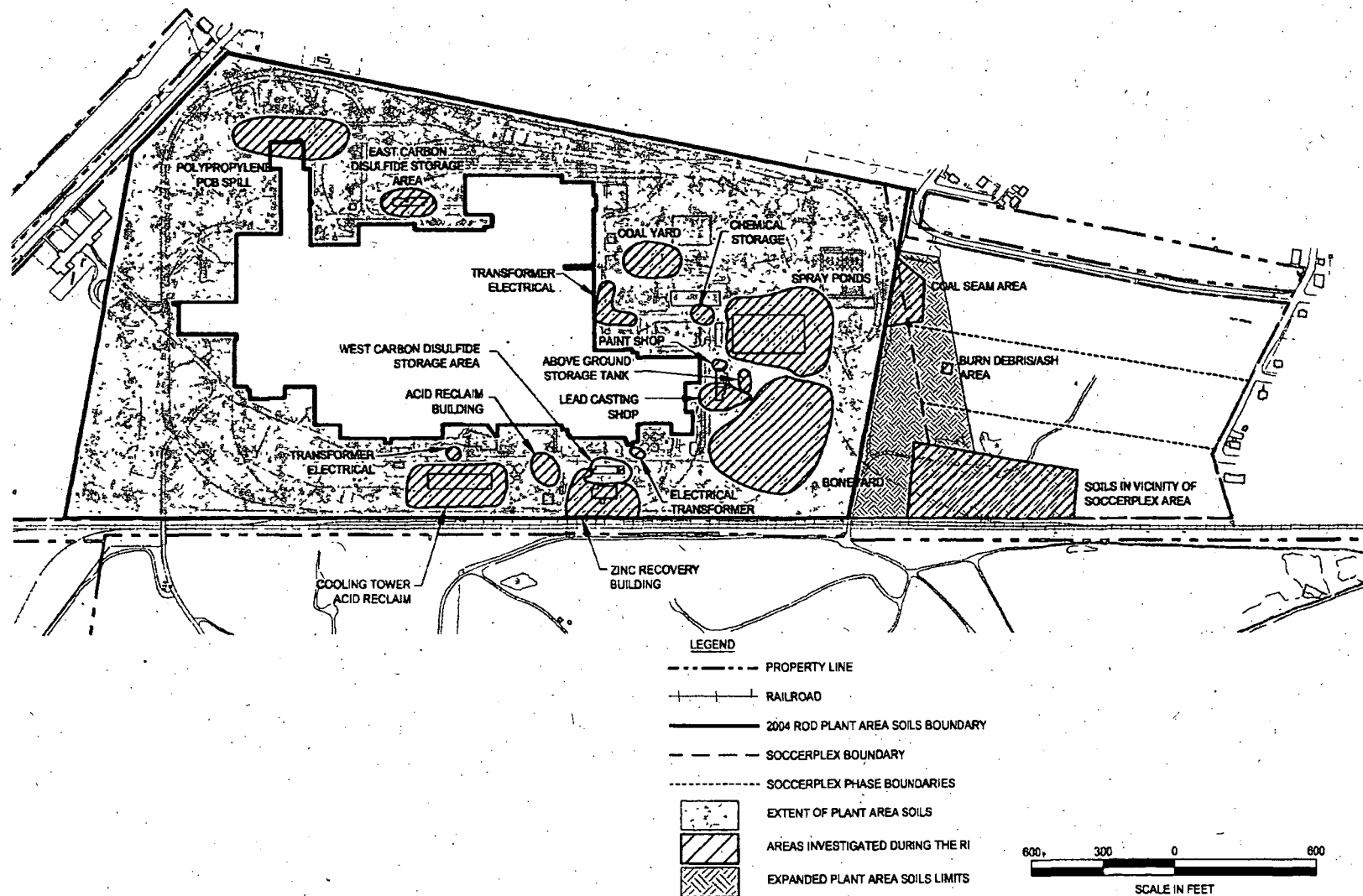
Ms. Bonnie Gross  
Remedial Project Manager  
Mailcode 3HS23  
U S. Environmental Protection Agency, Region III  
1650 Arch Street  
Philadelphia, PA 19103  
(215) 814-3229

1/10/06  
Date

  
Abraham Ferdas, Director  
Hazardous Site Cleanup Division

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**FIGURE 3A**  
**REVISED PLANT AREA SOILS BOUNDARY**  
**AVTEX SUPERFUND SITE**  
**FRONT ROYAL, VIRGINIA**



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MLB/12-09-05

ERM INC

**Table 1A - Avtex Fibers Operable Unit 10**  
**OU-10 Expanded Plant Area Soils**  
**Soil Cleanup Standards for**  
**Direct Contact and Ground Water Protection**

**Derivation of OU-10 Expanded Plant Area Soils Cleanup Standards**

The soil cleanup standards for the OU-10 Expanded Plant Area Soils shall not result in a cumulative excess cancer risk above  $1 \times 10^{-4}$ . The cumulative effect for non-carcinogens on any target organ shall not exceed a HQ of 1. All soils shall meet the direct contact human health standards and the groundwater protection standards.

The risk-based numeric soil cleanup standards for the OU-10 Expanded Plant Area Soils for the protection of human health due to direct contact shall be the direct contact standards calculated according to the procedures utilized in the EPA Region III Risk-based Concentration Table for residential soil. The direct contact cleanup standards shall be based on a  $1 \times 10^{-5}$  risk level for carcinogens and a HQ of 1 for non-carcinogens if it can be demonstrated that there are no more than 10 carcinogens present in excess of the  $1 \times 10^{-6}$  risk level, and that none of the non-carcinogens exceeding a HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the  $1 \times 10^{-6}$  risk level, the direct contact cleanup standards shall be the levels identified for a  $1 \times 10^{-6}$  excess cancer risk. The cumulative risks for non-carcinogens that have the same target organ must not exceed a HQ of 1, therefore, the direct contact cleanup standards for non-carcinogens having the same target organ shall be the levels for a HQ of 0.1. Each of the individual PCBs listed in Table 1A shall be considered a carcinogen for the purpose of determining the number of carcinogens. For non-carcinogens, if none of the non-carcinogens exceeding a HQ of 0.1 have the same target organ, the direct contact standards shall be the concentrations identified for a HQ of 1 in Table 1A. If any two or more of the non-carcinogens exceed a HQ of 0.1 and have the same target organ, the direct contact standards for the non-carcinogens with the same target organ shall be the concentrations for a HQ of 0.1 identified in Table 1A and the cumulative effect of the non-carcinogens on the target organ shall not exceed a HQ of 1. The direct contact cleanup standard for total PCBs shall be 1 ppm.

The soil cleanup standards for the OU-10 Expanded Plant Area Soils for the protection of ground water (i.e., ground water protection soil standards) shall be used to identify allowable chemical concentrations in soil, these are the same standards as presented in the OU-10 ROD for Plant Area Soils. The objective of the ground water protection soil standard is to ensure that soil quality does not adversely affect ground water quality. Consistent with EPA guidance and allowing for Site ground water as a drinking water source, the ground water protection soil standards are the Safe Drinking Water Act (SDWA) Maximum Contaminant Level Goal (MCLG) if the MCLG is not zero. In the absence of a non-zero MCLG, the Maximum Contaminant Level (MCL) is the ground water protection soil standard. If neither a non-zero MCLG nor an MCL have been established for a compound, the ground water protection soil standard for a compound is the April 2003 Region III risk-based screening concentration for the ingestion of tap water. The method to determine compliance with the ground water protection soil standards, which are based on these requirements, is described below.

The approach first involves using Synthetic Precipitation Leaching Procedure (SPLP) data to determine the concentration of a contaminant that could be leached from the soil into pore water. The second step consists of applying a DAF of 10 to conservatively estimate the concentration that could occur in ground water beneath the source soils. The SPLP concentration divided by the DAF of 10 is compared to the ground water protection soil standard. Remediation shall be required when the SPLP concentration divided by 10 exceeds the ground water protection soil standard in Table 1A, in which case the soil cleanup level for that contaminant shall be the ground water protection soil standard identified in the table.

Parameter	Carcinogen Or Non- Carcinogen	Human Health Direct Contact Standard <sup>1,2</sup>		Ground Water Protection Standard <sup>3</sup> (mg/L)		Target Organ <sup>5</sup>
		1x10 <sup>-6</sup> Cancer Risk and/or Hazard Quotient =0.1	1x10 <sup>-5</sup> Cancer Risk and/or Hazard Quotient =1.0	RBC or MCL <sup>4</sup>		
Volatile Organic Compounds (VOCs)						
1,1,2,2-Tetrachloroethane	c	3.2	32	0.000053	RBC	
1,1,1-Trichloroethane	nc	2,200	22,000	0.2	MCLG	
1,1,2-Trichloroethane	c	1.1	11	0.003	MCLG	
1,1-Dichloroethane	nc	1,600	16,000	0.8	RBC	
1,1-Dichloroethene	nc	390	3,900	0.007	MCLG	

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Table 1A (Continued)

Parameter	Carcinogen Or Non- Carcinogen	Human Health Direct Contact Standard <sup>1,2</sup>		Ground Water Protection Standard <sup>3</sup> (mg/L)		Target Organ <sup>5</sup>
		1x10 <sup>-6</sup> Cancer Risk and/or Hazard Quotient =0.1	1x10 <sup>-5</sup> Cancer Risk and/or Hazard Quotient =1.0	RBC or MCL <sup>4</sup>		
1,2-Dibromo-3-chloropropane	c	0.46	4.6	0.0002	MCL	
1,2-Dibromoethane	c	0.32	3.2	0.00000075	RBC	
1,2-Dichloroethane	c	7.0	70	0.005	MCL	
1,2-Dichlorobenzene	nc	700	7,000	0.6	MCLG	
1,2,4-Trichlorobenzene	nc	78	780	0.07	MCLG	
1,3-Dichlorobenzene	nc	23	230	0.18	RBC	
1,4-Dichlorobenzene	c	27	270	0.075	MCLG	
1,2-Dichloropropane	c	9.4	94	0.005	MCL	
2-Butanone (MEK)	nc	4,700	47,000	1.9	RBC	
2-Hexanone	nc	313	3,130	1.5	RBC	
4-Methyl-2-pentanone (MIBK)	nc	NV	NV	NV		
Acetone	nc	7,000	70,000	0.61	RBC	
Benzene	c	12	120	0.005	MCL	
Bromochloromethane	-	NV	NV	NV		
Dibromodichloromethane	c	10	100	0.08	MCL <sup>4</sup>	
Bromoform	c	81	810	0.08	MCL <sup>4</sup>	
Bromomethane	nc	11	110	0.0085	RBC	
Carbon disulfide	nc	780	7,800	1	RBC	
Carbon tetrachloride	c	4.9	49	0.005	MCL	
Chlorobenzene	nc	160	1,600	0.1	MCLG	
Chloroethane	c	220	2,200	0.0036	RBC	
Chloroform	nc	78	780	0.08	MCL <sup>4</sup>	
Chloromethane	c	NV <sup>7</sup>	NV <sup>7</sup>	0.19	RBC	
cis-1,2-Dichloroethene	nc	78.2	782	0.07	MCLG	
cis-1,3-Dichloropropene <sup>6</sup>	c	6.4	64	0.00044	RBC	
Dibromochloromethane	c	7.6	76	0.06	MCLG <sup>4</sup>	
Ethylbenzene	nc	780	7,800	0.7	MCLG	
Methylene chloride	c	85	850	0.005	MCL	
Styrene	nc	1,600	16,000	0.1	MCLG	
Tetrachloroethene	c	1.2	12	0.005	MCL	
Toluene	nc	630	6,300	1	MCLG	
trans-1,2-Dichloroethene	nc	160	1,600	0.1	MCLG	
trans-1,3-Dichloropropene <sup>6</sup>	c	6.4	64	0.0004	RBC	
Trichloroethene	c	1.6	16	0.005	MCL	
Vinyl chloride	c	0.09	0.9	0.002	MCL	
Alkenes (total)	nc	1,600	16,000	10	MCLG	

Table 1A (Continued)

Parameter	Carcinogen Or Non- Carcinogen	Human Health Direct Contact Standard <sup>1,2</sup>		Ground Water Protection Standard <sup>3</sup> (mg/L)		Target Organ <sup>5</sup>
		1x10 <sup>-6</sup> Cancer Risk and/or Hazard Quotient =0.1	1x10 <sup>-5</sup> Cancer Risk and/or Hazard Quotient =1.0	RBC or MCL <sup>4</sup>		
Semivolatile Organic Compounds (SVOCs)						
1,2-Diphenylhydrazine	c	0.8	8.0	0.000084	RBC	
2,2'Oxybis (1-Chloropropane)	-	NV	NV	NV		
2,4,5-Trichlorophenol	nc	780	7,800	3.7	RBC	
2,4,6-Trichlorophenol	c	58	580	0.0061	RBC	
2,4-Dichlorophenol	nc	23	230	0.11	RBC	
2,4-Dimethylphenol	nc	160	1,600	0.73	RBC	
2,4-Dinitrophenol	nc	16	160	0.073	RBC	
2,4-Dinitrotoluene	nc	16	160	0.073	RBC	
2,6-Dinitrotoluene	nc	7.8	78	0.037	RBC	
2-Chloronaphthalene	nc	630	6,300	0.49	RBC	
2-Chlorophenol	nc	39	390	0.03	RBC	
2-Methylnaphthalene	nc	31	310	0.12	RBC	Pulmonary effects (13)
2-Nitroaniline	-	NV	NV	NV		
2-Nitrophenol	-	NV	NV	NV		
3,3'-Dichlorobenzidine	c	1.4	14	0.00015	RBC	
3-Nitroaniline	nc	23	23	0.0033	RBC	
4,6-Dinitro-2-methylphenol	nc	0.78	7.8	0.0037	RBC	
4-Bromophenyl phenyl ether	-	NV	NV	NV		
4-Chloroaniline	nc	31	310	0.15	RBC	
4-Chlorophenyl phenyl ether	-	NV	NV	NV		
4-Nitroaniline	nc/c	23.5/32	235/320	0.0033	RBC	
4-Nitrophenol	nc	62.6	626	0.29	RBC	
Acenaphthene	nc	470	4,700	0.37	RBC	Liver effects (8)
Acenaphthylene	-	NV	NV	NV		
Anthracene	nc	2,300	23,000	1.8	RBC	Oral Liver effects (9) Skin effects (2, 6)
Benidine	c	0.0028	0.028	0.00000029	RBC	
Benzo(a)anthracene	c	0.87	8.7	0.000092	RBC	
Benzo(a)pyrene	c	0.087	0.97	0.0002	MCL	
Benzo(b)fluoranthene	c	0.87	8.7	0.000092	RBC	
Benzo(g,h,i)perylene	-	NV	NV	NV		
Benzo(k)fluoranthene	c	8.7	87	0.00092	RBC	
bis(2-Chloroethoxy)methane	-	NV	NV	NV		
Bis(2-chloroethyl)ether	c	0.58	5.8	0.0000096	RBC	
Bis(2-chloroisopropyl ether)	c	9.1	91	0.00026	RBC	
Bis(2-ethylhexyl)phthalate	c	46	460	0.006	MCL	
Butylbenzyl phthalate	c	340	3,400	7.3	RBC	Increased liver & brain weight effects (8)

Table 1A (Continued)

Parameter	Carcinogen Or Non- Carcinogen	Human Health Direct Contact Standard <sup>1,2</sup>		Ground Water Protection Standard <sup>3</sup> (mg/L)		Target Organ <sup>5</sup>
		1x10 <sup>-6</sup> Cancer Risk and/or Hazard Quotient =0.1	1x10 <sup>-5</sup> Cancer Risk and/or Hazard Quotient =1.0	RBC or MCL <sup>4</sup>		
Carbazole	c	32	320	0 0033	RBC	
p-Chloro-m-cresol	-	NV	NV	NV		
Chrysene	c	87	870	0 0092	RBC	
Di-n-butylphthalate	nc	780	7,800	3 7	RBC	Oral Developmental Effects (9)
Di-n-octyl phthalate	nc	313	3,130	0 73	RBC	Oral Liver effects (9) Gastrointestinal (2) and neurological effects (5)
Dibenz(a,h)anthracene	c	0 087	0 87	0 0000092	RBC	
Dibenzofuran	nc	15 6	156	0 012	RBC	
Diethylphthalate	nc	6,300	63,000	29	RBC	
Dimethyl phthalate	nc	78,200	782,000	370	RBC	Gastrointestinal and neurological effects (5)
Fluoranthene	nc	310	3,100	1 5	RBC	Liver & kidney & blood effects (8)
Fluorene	nc	310	3,100	0 24	RBC	Blood effects (8)
Hexachlorobenzene	c	0 4	4 0	0 001	MCL	
Hexachlorobutadiene <sup>8</sup>	nc/c	1 56/8 2	15 6/82	0 00086	RBC	
Hexachlorocyclopentadiene	nc	47	470	0 05	MCLG	
1,1,1-Trichloroethane <sup>8</sup>	nc/c	7 8/46	78/460	0 0048	RBC	
Benzo(a)pyrene	c	0 87	8 7	0 000092	RBC	
Isophorone	c	670	6,700	0 07	RBC	
n-Nitrosodiphenylamine	c	130	1,300	0 014	RBC	
n-Nitrosodipropylamine	c	0 091	0 91	0 0000096	RBC	
Naphthalene	nc	160	1,600	0 0065	RBC	Decreased weight effects (8)
Nitrobenzene	nc	3 9	39	0 0035	RBC	
p-Chloro-m-cresol	-	NV	NV	NV		
p-(Dimethylamino)azobenzene	-	NV	NV	NV		
Pentachlorobenzene	nc	6 3	63	0 029	RBC	
Pentachlorophenol	c	2 5	25	0 001	MCL	
Phenanthrene	-	NV	NV	NV		Skin effects (6, 7)
o-Cresol/2-Methylphenol	nc	390	3,900	1 8	RBC	
p-Cresol/4-Methylphenol	nc	39	390	0 18	RBC	
Phenol	nc	2,300	23,000	11	RBC	
Pyrene	nc	230	2,300	0 18	RBC	Kidney effects (8)
Metals						
Aluminum	nc	7,820	78,200	37	RBC	
Antimony	nc	3 1	31	0 006	MCLG	Blood effects (8)
Arsenic	c	15 9 <sup>13</sup>	15 9 <sup>13</sup>	0 01	MCL	Oral Skin-Hyperpigmentation/ hyperkeratosis Inhal Respiratory-Respiratory toxicity (8)
Barium	nc	1,600	16,000	2	MCLG	Kidney effects (8)
Beryllium	nc	16	160	0 004	MCLG	Intestinal Lesions (8)

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Table 1A (Continued)

Parameter	Carcinogen Or Non- Carcinogen	Human Health Direct Contact Standard <sup>1,2</sup>		Ground Water Protection Standard <sup>3</sup> (mg/L)		Target Organ <sup>5</sup>
		1x10 <sup>-6</sup> Cancer Risk and/or Hazard Quotient =0.1	1x10 <sup>-5</sup> Cancer Risk and/or Hazard Quotient =1.0	RBC or MCL <sup>4</sup>		
Cadmium	nc	78	78	0.005	MCLG	Kidney effects (8)
Calcium	-	NV	NV	NV		
Chromium	nc	233 <sup>13</sup>	233 <sup>13</sup>	0.1	MCLG	Cr6 Oral GI System-Gastrointestinal effects Cr6 Inhal Respiratory-Direct nasal effects Cr3 Oral Reproduction-Reproductive effects (parental) Cr3 Inhal Not specified (8)
Cobalt	nc	156	1,560	0.73	RBC	Inhalation Respiratory effects Oral Liver Effects (9)
Copper	nc	310	3,100	1.3	MCLG	Oral Gastrointestinal effects (9)
Iron	nc	2,300	23,000	11	RBC	
Lead	nc	400 <sup>9</sup>	400 <sup>9</sup>	0.015	AL <sup>4</sup>	Blood and brain effects (7)
Magnesium	-	NV	NV	NV		
Manganese	nc	2,272 <sup>13</sup>	2,272 <sup>13</sup>	0.73	RBC	Oral and Inhal CNS-Neurotoxicity (13)
Mercury <sup>10</sup>	nc	0.78	7.8	0.002	MCLG	Neurological effects (8)
Nickel	nc	160	1,600	0.73	RBC	Decreased body and organ weight effects (8)
Potassium	-	NV	NV	NV		
Selenium	nc	39	290	0.05	MCLG	Skin & hair & nail effects (8)
Silver	nc	39	390	0.18	RBC	Skin effects (8)
Sodium	-	NV	NV	NV		
Thallium	nc	0.55	5.5	0.0005	MCLG	Blood (8) & liver (4) effects & hair loss (1, 4)
Vanadium	nc	184 <sup>13</sup>	184 <sup>13</sup>	0.26	RBC	Oral and Inhal Hair-decreased hair cystine (8) Oral Kidney effects (9)
Zinc	nc	2,300	23,000	11	RBC	Blood effects (8)
Cyanide, Free	nc	1,600	16,000	0.2	MCLG	
Polychlorinated Biphenyls (PCBs)						
Total PCBs-	c	NA	1 <sup>11</sup>	0.0005	MCL	
Arochlor 1016	nc/c	5.5/9.12 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	Reduced birth weight (8)
Arochlor 1221	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	
Arochlor 1232	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	
Arochlor 1242	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	
Arochlor 1248	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	
Arochlor 1254	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	
Arochlor 1260	c	0.32 <sup>12</sup>	NA <sup>12</sup>	0.0005	MCL	

Notes: NV - No Value Available; c = carcinogenic effects; nc = carcinogenic effects; nc/c = noncarcinogenic effects/carcinogenic effects

1 - The direct contact standards are calculated according to procedures utilized in the EPA Region III Risk-based Concentration Table (October 25, 2005 Version) for residential soil. The default lead direct contact exposure standard is 400mg/kg based on typical residential exposure. Chromium direct contact exposure standard based on Cr<sup>6</sup>.

2 - The direct contact cleanup goals based on a 1 x 10<sup>-5</sup> risk level for carcinogens and a HQ of 1 for non-carcinogens are applicable if it can be demonstrated that there are no more than 10 carcinogens present in excess of the 1 x 10<sup>-6</sup> risk level, and that none of the noncarcinogens

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# Table 1A (Continued)

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exceeding an HQ of 0.1 have the same target organ. If more than 10 carcinogens are present in excess of the  $1 \times 10^{-6}$  risk level, the direct contact cleanup goals will be the levels identified for a  $1 \times 10^{-6}$  excess cancer risk. The cumulative risks for non-carcinogens that have the same target organ must not exceed a HQ of 1, therefore, the direct contact cleanup goals for non-carcinogens having the same target organ will be the levels identified for a HQ = 0.1.

3 - Determination of whether or not ground water protection standards are met is made by dividing the SPLP concentration by the DAF of 10 and then comparing the concentration to the standard (MCLG, MCL or RBC). Concentrations lower than the standards are in compliance with the standards.

4 - Safe Drinking Water Act (SDWA) Maximum Contaminant Level Goal (MCLG) if the MCLG is not zero. In the absence of a non-zero MCLG, the Maximum Contaminant Level (MCL) is the ground water protection standard. If neither a non-zero MCLG nor an MCL have been established for a compound, the groundwater protection standard is the current Region III risk-based screening concentration (RBC) for tap water. Lead ground water protection action level (AL) assumed to be 0.015 mg/L based on SDWA standards.

Bromodichloromethane, Bromoform, Chloroform, and Dibromochloromethane are trihalomethanes; the total of the trihalomethanes can not exceed 0.08 mg/L.

5 - Target organs are shown for those non-carcinogenic constituents detected in the NTCRA-Buildings samples. If additional non-carcinogenic constituents are detected during future sampling, the table will be revised to include the corresponding target organs.

6 - 1,3-Dichloropropene standard was used.

7 - EPA Region III removed direct contact standard for chloromethane in the April 2003 update of the risk-based concentrations.

8 - 4-Nitroaniline, Hexachloroethane, and Hexachlorobutadiene are listed as carcinogens, however, the non-carcinogenic standards at an HQ=0.1 and an HQ=1.0 are less than the carcinogenic standards at  $1 \times 10^{-6}$  and  $1 \times 10^{-5}$ , respectively. Both non-carcinogenic and carcinogenic standards are shown.

9 - The soil cleanup level for lead of 400 mg/kg is the only value used and is irrespective of the HQ.

10 - Methylmercury direct contact standard was used as the default standard for mercury.

11 - The OU-10 direct contact soil cleanup standard for PCBs is 1 mg/kg Total (see note 12). This cleanup standard is risk-based and is consistent with the substantive standards of 40 CFR § 761.61(c). While none of the cleanup levels found in 40 CFR § 761.61 are applicable to CERCLA cleanups [see 40 CFR § 761.61(a)(1)(ii)], EPA determined that the risk-based cleanup approach found in 40 CFR § 761.61(c) is relevant and appropriate to this cleanup, and that the 1 mg/kg Total PCB cleanup level will not pose an unreasonable risk of injury to health or the environment. EPA also notes that this level is also consistent with EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination," EPA 540 G-90-007, August 1990. Page 27, Table 3-1.

12 - The  $1 \times 10^{-6}$  Arochlor-specific direct contact cleanup standards for PCBs will only be used to determine if there are more than 10 carcinogens present that exceed the  $1 \times 10^{-6}$  risk level direct contact cleanup standards. If more than 10 carcinogens exceed the  $10^{-6}$  risk level direct contact cleanup standards, then the non-PCB carcinogens will be compared to their respective  $1 \times 10^{-6}$  risk level direct contact cleanup standards, and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. If 10 or less carcinogens are present that exceed the  $1 \times 10^{-6}$  risk level direct contact cleanup standards, the non-PCB carcinogens will be compared to their respective  $1 \times 10^{-5}$  risk level direct contact cleanup standards and the total PCB concentration will be compared to the 1 mg/kg direct contact cleanup standard. A soil direct contact cleanup standard for the  $1 \times 10^{-5}$  cancer risk level is not applicable (NA) for PCBs for use at OU-10.

13 - Upper Tolerance Limit (UTL) calculated from the Virginia data in Boerngen and Shacklette (1981).

## Target Organ Notes:

- (1) Beliles, 1994 (Patty's Industrial Hygiene and Toxicology)
- (2) Lewis, 1992 (Sax's Dangerous Properties of Industrial Materials)
- (3) ATSDR, 2000 (Toxicological profile for lead)
- (4) USEPA, 1997 (HEAST)
- (5) Bisesi, 1994 (Patty's Industrial Hygiene and Toxicology)

- (6) Cavender, 1994 (Patty's Industrial Hygiene and Toxicology)
- (7) ATSDR, 2000 (Toxicological Profile for Phenanthrene)
- (8) USEPA IRIS data base October 2005
- (9) ATSDR, 2004 (Minimal Risk Levels)

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